

PATENT

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In the United States Patent and Trademark Office

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Applicant: Rosenberg

Applicant's Ref: IMM005B

Application No: unassigned

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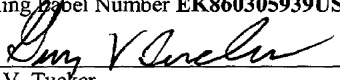
Title: Laparoscopic Simulation Interface
(as amended)

Examiner: C. Nguyen

Group Art Unit: 2675

CERTIFICATE OF EXPRESS MAILING

I hereby certify that this paper and the documents and/or fees referred to as attached therein are being deposited with the United States Postal Service on May 09, 2001 in an envelope as "Express Mail Post Office to Addressee" service under 37 CFR §1.10, Mailing Label Number **EK860305939US**, addressed to the Commissioner for Patents, Washington, DC 20231.


Guy V. Tucker

AMENDMENT A

Commissioner for Patents
Washington, D.C. 20231

Dear Commissioner and Examiner:

This amendment is being filed preliminary to examination. The present amendment is being filed in accordance with amended rule 37 CFR 1.121. Thus, clean versions of any amended portions of the specification and claims are provided herein. Marked-up versions of the amendments are provided on one or more separate sheets following the REMARKS section.

CLEAN VERSION OF AMENDMENTS

In the title:

Please amend the title to read:

--Laparoscopic Simulation Interface--

In the specification:

The following is a clean version of the paragraphs and/or sections of the specification amended by the present amendment.

Before the first line of the specification, insert:

--This application is a continuation of copending prior application Serial No. 08/870,956 filed on June 6, 1997, which is a continuation of application Serial No. 08/374,288, filed on January 18, 1995, now U.S. Patent No. 5,731,804, both of which are incorporated herein by reference in their entireties.--

On page 1, line 10, before "Background of the Invention", insert the paragraph:

--This invention was made with Government support under Contract Number III-9361801 awarded by the National Science Foundation, and Contract Number DE-FG03-94ER86008 awarded by the Department of Energy. The Government has certain rights in this invention.--

On page 16, replace the third paragraph with the following:

-- Optionally, additional transducers can be added to apparatus 25' to provide additional degrees of freedom for object 44. For example, a transducer can be added to grip 26 of laparoscopic tool 18 to sense when the user moves the two portions 26a and 26b relative to each other to simulate extending the cutting blade of the tool. Such a laparoscopic tool sensor is described in U.S. Patent Application Serial No. 08/275,120, now Patent No. 5,623,582, filed July 14, 1994 and entitled "Method and Apparatus for Providing Mechanical I/O for Computer Systems" assigned to the assignee of the present invention and incorporated herein by reference in its entirety.--

On page 20, replace the first full paragraph with the following:

--Other drive mechanisms can also be used to transmit forces to linear axis member and receive positional information from member 40 along axis C. For example, a drive wheel made of a rubber-like material or other frictional material can be positioned on shaft 98 to contact linear axis member 40 along the edge of the wheel. The wheel can cause forces along member 40 from the friction between wheel and linear axis member. Such a drive wheel mechanism is disclosed in the abovementioned Application Serial No. 08/275,120 now Patent No. 5,623,582 as well as in U.S. Patent Application Serial No. 08/344,148, filed November 23, 1994 and entitled "Method and Apparatus for Providing Mechanical I/O for Computer Systems Interfaced with Elongated Flexible Objects" assigned to the assignee of the present invention and incorporated herein by reference in its entirety. Linear axis member 40 can also be a single shaft in alternate embodiments instead of a dual part sleeve and shaft.--

On pages 22 and 23, replace the bridging paragraph with:

-- Figure 9 is a schematic view of a computer 16 and an interface circuit 120 used in interface 14 to send and receive signals from mechanical apparatus 25. Circuit 120 includes computer 16, interface card 120, DAC 122, power amplifier circuit 124, digital sensors 128, and sensor interface 130. Optionally included are analog sensors 132 instead of or in addition to digital sensors 128, and ADC 134. In this embodiment, the interface 14 between computer 16 and mechanical apparatus 25 as shown in Figure 1 can be considered functionally equivalent to the interface circuits enclosed within the dashed line in Figure 14. Other types of interfaces 14 can also be used. For example, an electronic interface 14 is described in U.S. Patent Application Serial No. 08/092,974, filed July 16, 1993 and entitled "3-D Mechanical Mouse" assigned to the assignee of the present invention, which is the parent of file wrapper continuation application Serial No. 08/461,170, now U.S. Patent No. 5,576,727, and incorporated herein by reference in its entirety. The electronic interface described therein was designed for the Immersion PROBE™ 3-D mechanical mouse and has six channels corresponding to the six degrees of freedom of the Immersion PROBE.--

In the claims:

The following is a complete listing of a clean version of the presently pending claims (note that all claims have been reproduced for the Examiner's convenience; claims amended and added hereby are so indicated by the parenthetical expressions "amended" and "new", respectively):

44. (new) An apparatus for interfacing a user with a computer providing a laparoscopic surgical simulation, the apparatus comprising:

a user object comprising a handle and an elongated member;

a gimbal mechanism receiving the user object and allowing the user object to be manipulated in first, second and third rotary degrees of freedom and in a first translational degree of freedom, the gimbal mechanism comprising a five member linkage to provide the first and second rotary degrees of freedom; and

a sensing system coupled to the gimbal mechanism to detect manipulation of the user object in the first, second, and third rotational degrees of freedom and in the first translational degree of freedom;

whereby the sensing system provides input to the computer to control the laparoscopic surgical simulation.

45. (new) An apparatus according to claim 44 further comprising a handle sensor coupled to the handle to detect manipulation of at least a portion of the handle.

46. (new) An apparatus according to claim 44 wherein the handle comprises relatively pivotable portions.

47. (new) An apparatus according to claim 46 further comprising a sensor coupled to the handle to detect relative motion of the pivotable portions.

48. (new) An apparatus according to claim 44 wherein the handle comprises a finger wheel.

49. (new) An apparatus according to claim 44 further comprising a barrier between the handle and the gimbal mechanism.

50. (new) An apparatus according to claim 44 further comprising a trocar between the handle and the gimbal mechanism.

51. (new) An apparatus for interfacing a user with a computer providing a laparoscopic surgical simulation, the apparatus comprising:

- a user object comprising a handle and an elongated member;
- a gimbal mechanism receiving the user object and allowing the user object to be manipulated in first, second and third rotary degrees of freedom and in a first translational degree of freedom, the gimbal mechanism comprising a five member linkage to provide the first and second rotary degrees of freedom;
- a sensing system coupled to the gimbal mechanism to detect manipulation of the user object in the first, second, and third rotational degrees of freedom and in the first translational degree of freedom; and
- an actuator coupled to the gimbal mechanism to output a force to the user in one or more of the degrees of freedom;

whereby the sensing system provides input to the computer to control the laparoscopic surgical simulation and the actuator outputs one or more forces associated with the simulation.

52. (new) An apparatus according to claim 51 wherein the actuator comprises a motor.

53. (new) An apparatus according to claim 51 wherein the actuator comprises a braking mechanism.

54. (new) An apparatus according to claim 51 further comprising additional actuators so that forces may be output in each of the first, second, and third rotational degrees of freedom and in the first translational degree of freedom.

55. (new) An apparatus according to claim 51 further comprising a barrier between the handle and the gimbal mechanism.

56. (new) An apparatus according to claim 51 further comprising a trocar between the handle and the gimbal mechanism.

57. (new) An apparatus for interfacing a user with a computer providing a laparoscopic surgical simulation, the apparatus comprising:

- a user object comprising a handle and an elongated member;
- a gimbal mechanism receiving the user object and allowing the user object to be manipulated in first, second and third rotary degrees of freedom and in a first translational degree of freedom;
- a sensing system coupled to the gimbal mechanism to detect manipulation of the user object in the first, second, and third rotational degrees of freedom and in the first translational degree of freedom; and
- an actuator coupled to the gimbal mechanism through a cable and pulley to output a force to the user in one or more of the degrees of freedom;

whereby the sensing system provides input to the computer to control the laparoscopic surgical simulation and the actuator outputs one or more forces associated with the simulation.

58. (new) An apparatus according to claim 57 wherein the actuator is coupled to the gimbal mechanism through the cable and pulley to provide a force to the user in the first translational degree of freedom.

59. (new) An apparatus according to claim 57 wherein the gimbal mechanism comprises a five member linkage to provide the first and second rotary degrees of freedom.

60. (new) An apparatus according to claim 59 wherein the actuator is coupled to the five member linkage through the cable and pulley to provide a force to the user in the first or second rotary degrees of freedom.

61. (new) An apparatus according to claim 60 further comprising a second actuator coupled to the five member linkage through another cable and pulley to provide a force to the user in the first or second rotary degrees of freedom.

62. (new) An apparatus according to claim 57 wherein the cable transmits a force from the pulley to a capstan drum, the capstan drum being coupled to the gimbal.

REMARKS

Claims 44-62 are presently pending in the case. Claims 1-43 have been cancelled without prejudice or disclaimer, Applicant reserving the right to pursue the claims in related applications. Claims 44-62 have been added.

The amendments are supported by the specification and claims as originally filed.

Information Disclosure Statement

Applicant is filing herewith an information disclosure statement in compliance with MPEP section 609. Indication of consideration of the references provided is requested.

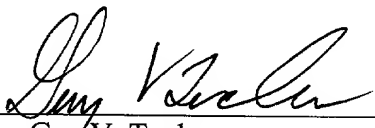
Conclusion

The Examiner is respectfully requested to consider and allow the presently pending claims. Should the Examiner have any questions, the Examiner is requested to call the undersigned at the number given below.

Respectfully submitted,

IMMERSION CORPORATION

Dated: May 9, 2001

By: 
Guy V. Tucker
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[illegible]

In the specification:

--Laparoscopic Simulation Interface--

--This application is a continuation of copending prior application Serial No. 08/870,956 filed on June 6, 1997, which is a continuation of application Serial No. 08/374,288, filed on January 18, 1995, now U.S. Patent No. 5,731,804, both of which are incorporated herein by reference in their entireties.--

--This invention was made with Government support under Contract Number III-9361801 awarded by the National Science Foundation, and Contract Number DE-FG03-94ER86008 awarded by the Department of Energy. The Government has certain rights in this invention.--

On page 16, line 25, insert --now Patent No. 5,623,582,-- after “08/275,120”.

On page 20, line 8, insert --now Patent No. 5,623,582,-- after “08/275,120”.

On page 22, line 35, insert --, which is the parent of file wrapper continuation application Serial No. 08/461,170, now U.S. Patent No. 5,576,727,-- after “invention”.

In the claims:

Please cancel claims 1-43 without prejudice or disclaimer.

Please add the following new claims:

44. An apparatus for interfacing a user with a computer providing a laparoscopic surgical simulation, the apparatus comprising:

a user object comprising a handle and an elongated member;

a gimbal mechanism receiving the user object and allowing the user object to be manipulated in first, second and third rotary degrees of freedom and in a first translational degree of freedom, the gimbal mechanism comprising a five member linkage to provide the first and second rotary degrees of freedom; and

a sensing system coupled to the gimbal mechanism to detect manipulation of the user object in the first, second, and third rotational degrees of freedom and in the first translational degree of freedom;

whereby the sensing system provides input to the computer to control the laparoscopic surgical simulation.

45. An apparatus according to claim 44 further comprising a handle sensor coupled to the handle to detect manipulation of at least a portion of the handle.

46. An apparatus according to claim 44 wherein the handle comprises relatively pivotable portions.

47. An apparatus according to claim 46 further comprising a sensor coupled to the handle to detect relative motion of the pivotable portions.

48. An apparatus according to claim 44 wherein the handle comprises a finger wheel.

49. An apparatus according to claim 44 further comprising a barrier between the handle and the gimbal mechanism.

50. An apparatus according to claim 44 further comprising a trocar between the handle and the gimbal mechanism.

51. An apparatus for interfacing a user with a computer providing a laparoscopic surgical simulation, the apparatus comprising:

a user object comprising a handle and an elongated member;

a gimbal mechanism receiving the user object and allowing the user object to be manipulated in first, second and third rotary degrees of freedom and in a first translational degree of freedom, the gimbal mechanism comprising a five member linkage to provide the first and second rotary degrees of freedom;

a sensing system coupled to the gimbal mechanism to detect manipulation of the user object in the first, second, and third rotational degrees of freedom and in the first translational degree of freedom; and

an actuator coupled to the gimbal mechanism to output a force to the user in one or more of the degrees of freedom;

whereby the sensing system provides input to the computer to control the laparoscopic surgical simulation and the actuator outputs one or more forces associated with the simulation.

52. An apparatus according to claim 51 wherein the actuator comprises a motor.

53. An apparatus according to claim 51 wherein the actuator comprises a braking mechanism.

54. An apparatus according to claim 51 further comprising additional actuators so that forces may be output in each of the first, second, and third rotational degrees of freedom and in the first translational degree of freedom.

55. An apparatus according to claim 51 further comprising a barrier between the handle and the gimbal mechanism.

56. An apparatus according to claim 51 further comprising a trocar between the handle and the gimbal mechanism.

57. An apparatus for interfacing a user with a computer providing a laparoscopic surgical simulation, the apparatus comprising:

- a user object comprising a handle and an elongated member;
- a gimbal mechanism receiving the user object and allowing the user object to be manipulated in first, second and third rotary degrees of freedom and in a first translational degree of freedom;
- a sensing system coupled to the gimbal mechanism to detect manipulation of the user object in the first, second, and third rotational degrees of freedom and in the first translational degree of freedom; and
- an actuator coupled to the gimbal mechanism through a cable and pulley to output a force to the user in one or more of the degrees of freedom;

whereby the sensing system provides input to the computer to control the laparoscopic surgical simulation and the actuator outputs one or more forces associated with the simulation.

58. An apparatus according to claim 57 wherein the actuator is coupled to the gimbal mechanism through the cable and pulley to provide a force to the user in the first translational degree of freedom.

59. An apparatus according to claim 57 wherein the gimbal mechanism comprises a five member linkage to provide the first and second rotary degrees of freedom.

60. An apparatus according to claim 59 wherein the actuator is coupled to the five member linkage through the cable and pulley to provide a force to the user in the first or second rotary degrees of freedom.

61. An apparatus according to claim 60 further comprising a second actuator coupled to the five member linkage through another cable and pulley to provide a force to the user in the first or second rotary degrees of freedom.

62. An apparatus according to claim 57 wherein the cable transmits a force from the pulley to a capstan drum, the capstan drum being coupled to the gimbal.